PRE-SERVICE TEACHERS' PERCEIVED USABILITY OF ONLINE PLATFORMS FOR LEARNING EDUCATIONAL TECHNOLOGY IN COLLEGES OF EDUCATION IN SOUTH-WEST, NIGERIA

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Abstract

The usability of online platforms such as google classroom, Edmodo and Educate for learning Educational Technology in the Colleges of Education is a function of ease of use, usefulness, ease of learning, accessibility and satisfaction, all which play crucial roles in determining how effectively these platforms are adopted and utilized by pre-service teachers. This study investigated pre-service teachers' perceived usability of online platforms for learning educational technology in colleges of education in South-West, Nigeria. Data were collected through structured questionnaire from pre-service teachers selected through multistage sampling techniques. Mean, and standard deviation were used for data analysis. Findings revealed that pre-service teachers perceived online platforms useful for learning, easy to learn, satisfactory for learning educational technology but perceived not easy to use. The study concluded that pre-service teachers had positive perception of online platforms for learning Educational Technology in the Colleges of Education in South-West, Nigeria. This study therefore recommended among others that; National Commission for Colleges of Education should review the curriculum of Colleges of Education with a view to incorporating the use of online platform for teaching. Initial training and orientation classes about online learning platforms should be provided for new students entering Colleges of Education. Lecturers in the Colleges of Education should use content lesson plans that include the integration of online learning platforms for teaching. Administrators of Colleges of Education should continuously organize seminars and conferences for the pre-service teachers and lecturers on the pedagogical uses of online learning platforms.

Introduction

The landscape of education has been undergoing a significant transformation, with a pronounced shift towards learner-centered instruction and the integration of technology into teaching and learning processes (Kuok & Tang, 2023). This evolution is particularly pertinent in the realm of pre-service teacher education, where future educators must be equipped with the skills to effectively utilize technology in their classrooms. In Nigerian Colleges of Education, Educational

Technology is a compulsory course (EDU 212) for pre-service teachers, designed to prepare pre-service teachers for the technological demands of modern classrooms. However, the delivery of this crucial course has faced challenges, primarily due to large class sizes and the limitations of traditional teaching methods. These conditions often result in passive learning experiences and diminished students' engagement (Diepreye, et al. 2019). To address these issues and align with contemporary educational practices, many lecturers have begun incorporating online learning platforms into their teaching methodologies. Several online platforms such as; Edmodo, Google Classroom and Educate have gained traction in the teaching of Educational Technology to pre-service teachers. Edmodo, a free social learning platform, allows educators to share course materials and facilitate virtual classroom interactions (Balasubramanian, et al. 2014). Google Classroom, a component of Google Apps for Education, enables easy management of teaching and learning processes, including assignment distribution and feedback (Shaharanee & Rodzi, 2018). The Educate Online Classroom App offers a holistic solution, integrating various tools for establishing an online presence in blended learning environments (Andortan, et al. 2022).

The usability of these online platforms for learning Educational Technology depends on the perception of pre-service teachers and it is influenced by several factors. According to Osman (2017) usability of online platforms is a function of ease of use, usefulness, ease of learning, accessibility, satisfaction to use, collaborative features, integration with existing systems, and relevance to course contents, all which play crucial roles in determining how effectively these platforms are adopted and utilized. Osman (2017) explained further that platforms that are intuitive, user-friendly, and accessible from various devices and locations are more likely to be embraced by pre-service teachers. Studies have shown that students' academic performance improved when online platforms are used in conjunction with traditional teaching methods (Albawi & Ghazi, 2019). The interactive features of these platforms can increase students' engagement and interest in the course content, fostering a more dynamic learning environment (Hursen, 2018).

Moreover, regular use of these platforms helps pre-service teachers develop technological competencies crucial for their future teaching careers. This aligns with the growing need for educators who can effectively integrate technology into their teaching practices (Association for Educational Communication and Technology, 2020). Online platforms often promote independent learning, allowing students to manage their own learning processes more effectively, which is a valuable skill for future educators (Zimmerman & Schunk, 2001). However, the usability of online learning platforms is not without challenges. Technical issues, such as unreliable internet connectivity and limited access to necessary devices, can significantly impact usability (Olaleye, et al. 2017). Varying levels of digital literacy among pre-service teachers may also influence platform adoption. The availability of adequate training and ongoing support for both lecturers and students is crucial for effective platform use (Charoenwet & Christensen, 2016).

Many lecturers today have adopted these online platforms to supplement traditional in-class instruction in the form of blended learning for pre-service teachers in the Colleges of Education in South-West, Nigeria. Although, pre-service teachers who are 'digital native' are growing up using computers, and android cell phones capable of some of these online platforms for chatting with friends and creating groups and online discourse. However, the acceptance and use of the online platforms introduced in their learning activities is an important factor in determining the success

of these technologies for educational purpose. This is because the pre-service teachers might perceive online platforms not useful for learning.

Studies have indicated that pre-service teachers' perceptions should be investigated prior to application of new digital technologies into the classroom environments (Baltaci-Goktalay & Ozdilek, 2010; Scott & Ryan, 2009). Perception is the way something is understood, interpreted and organized by an individual. According to Pickens (2005), when an individual is confronted with a situation or stimuli, he/she interprets the stimuli into something meaningful based on prior experiences. In this context, when an individual is confronted with a new information technology, the individual can demonstrate behaviours ranging from complete rejection, active resistance to genuine acceptance (Keller, 2007). Therefore, if online platforms are to be beneficial for learning, it is important that from the pre-service teachers' perspectives, the platforms are not seen as being difficult or complex to use. Since the usability of online platforms is influenced by various factors, including ease of use, usefulness, ease of learning, accessibility, satisfaction to use, collaborative features, integration with existing systems, and relevance to course contents, this study was designed to determine pre-service teachers' perceived usability of online platforms for learning educational technology in colleges of education in South-West, Nigeria.

Purpose of the Study
This study investigated pre-service teachers' perceived usability of online platforms for learning educational technology in colleges of education in South-West, Nigeria. Specifically, the study determined ease of use, usefulness, ease of learning and satisfaction to use online platforms for learning educational technology in colleges of education in South-West, Nigeria

Research Questions
The following research questions were posed for this study
1. What is the pre-service teachers' perceived usefulness of online platforms for learning educational technology in colleges of education in South-West, Nigeria?
2. What is the pre-service teachers' perceived ease of use of online platforms for learning educational technology in colleges of education in South-West, Nigeria?
3. What is the pre-service teachers' perceived ease of learning of online platforms for learning educational technology in colleges of education in South-West, Nigeria?
4. What is the pre-service teachers' perceived satisfaction to use online platforms for learning educational technology in colleges of education in South-West, Nigeria?

Review of Related Literature
The review of related literature for this study focused on the following online platforms which are prominently use for educational technology in south-west, Nigeria: Edmodo, Google classroom and Educate platforms.

Edmodo
Edmodo is an educational platform designed to facilitate communication and collaboration among teachers, students, and parents. It offers a range of tools for distributing educational materials, including content, videos, homework, and assignments via the internet (Looi & Yusop, 2011). The platform's compatibility with various file types and integration with services like Google Drive enhances its versatility in the classroom. Edmodo's recognition by the American Association of School Librarians as one of the top 25 websites promoting innovation and

creativity underscores its significance in the educational technology landscape (Habley, 2011). The platform's ability to transform traditional classrooms has been well-documented. Kongchan (2013) demonstrated that integrating Edmodo and Google Docs fostered originality and enjoyment among students in English language acquisition compared to traditional methods. This aligns with Imam's (2019) assertion that the revolution in social networks and communication technology has created new avenues for enhancing educational systems. Edmodo's role in promoting student autonomy and facilitating virtual collaboration has been noted to accelerate the learning process and improve proficiency in online activities (BusinessWire, 2014).

Edmodo's functionality extends beyond basic content sharing. It enables teachers to enhance their evaluation capabilities by generating diverse assessments, including polls, quizzes, and fill-in-the-blank exercises (Chandler & Redman, 2013). The platform's dual nature as an instructional and social networking site contributes to its user-friendliness among students. Buescher (2010) suggests that Edmodo provides a simple means of incorporating technology into both students' assessments and the teaching process, shifting the focus from teacher-centered to student-centered learning (Schiller, 2011).

Despite its popularity, Edmodo has faced criticism, particularly in higher education contexts. Some scholars have pointed out its lack of customizability and flexibility compared to more adaptable Learning Management Systems like Moodle (Aydin & Tirkes, 2010). Concerns about privacy and data protection have also been raised (Trust, 2016; Pardo, 2014). Additionally, Edmodo's relatively basic features are often deemed insufficient for complex courses in higher education settings (Manca & Ranieri, 2013).

Google Classroom
Google Classroom is a free, web-based platform designed to facilitate communication, planning, and collaboration between educators and students. Part of the Google Apps for Education (GAFE) suite, it integrates with other Google tools like Gmail, Docs, and Drive (Bell, 2015). Google Classroom enables teachers to create and manage assignments, provide feedback, and share resources digitally. It supports various educational levels, from elementary to higher education, and has become increasingly popular for both in-person and remote learning environments (Iftakhar, 2016). The platform offers several key features that streamline the educational process. Teachers can create courses, distribute assignments, and provide real-time feedback. Students can submit work, access materials, and participate in discussions through a user-friendly interface (Pappas, 2015). Google Classroom also supports multiple teachers per course and allows for advance lesson planning. Its integration with Google Drive ensures that all files are organized and easily accessible, while its mobile app enables learning on-the-go (Piaralal et al., 2023).

Google Classroom presents numerous benefits for both educators and students. It's free, user-friendly, and time-efficient, automating many administrative tasks (Janzen, 2014). The platform supports flexible learning environments, facilitating both traditional and flipped classroom models (Mary, 2014). It enhances communication between teachers and students, promotes collaborative learning (Crawford, 2015), and aligns with Universal Design for Learning (UDL) principles by allowing customization of course materials to meet individual student needs (Lopes-Murphy, 2012). Despite its advantages, researchers have raised concerns about Google

Classroom. These include potential privacy risks associated with student data (Thompson & Green, 2020), limitations in supporting diverse teaching methods (Nguyen, 2019), and the possibility of exacerbating the digital divide for students without reliable internet access or suitable devices (Alvarez & Ramirez, 2021). Some critics argue that the platform may lack advanced features needed for comprehensive course management (Brown, 2018) and that over-reliance on Google's ecosystem could restrict exposure to alternative technologies (Davis, 2019). However, Google Classroom continues to evolve, with ongoing updates addressing many of these concerns and further improving its functionality for educational purposes.

Educate Online Classroom App
The Educate App is an online classroom tool designed specifically for educators and learners, functioning as a learning management system that facilitates interaction between instructors and students in a virtual social networking environment. Developed by Educate Online Inc. in the United States and launched in April 2022, the app supports various courses including English, Science, Math, Physics, Coding, Placement Preparation, and Languages (Zainnuri, 2016). This platform creates a virtual environment where users can create profiles, share opinions and information, participate in discussion forums, and access features such as courses, group discussions, quizzes, attendance tracking, analytics, bulletin boards, and personal messaging.

The Educate Online Classroom App offers multiple features that enhance students' engagement beyond traditional classroom settings. Key features include Live Classes, which allow for unlimited live sessions with a single click, and the ability for teachers to generate instant assessments and quizzes, engage in conversations with students, resolve uncertainties, and share announcements or motivational messages (Saiyad et al., 2021). The app also enables teachers to create batches for efficient management of the teaching and learning process, organize students into separate groups, and communicate with each batch individually through the chat feature. Additionally, it provides a user-friendly content delivery system and functions as a platform that empowers teachers to provide instructional materials, organize, and evaluate the learning process (Mosquera, 2017).

One of the significant advantages of the Educate App is its ability to understand and adapt to individual student needs, customizing the teaching and learning process accordingly. It features advanced servers with robust security measures and provides outstanding effectiveness in managing both online and offline students. The app's ease of use and smooth communication capabilities, even in low-bandwidth situations, have made it popular among educators. Teachers can quickly set up classrooms and utilize features such as test creation, homework sharing, assignment management, study material distribution, and fee administration without encountering challenges (Yonas et al., 2023). The app also automatically records students' attendance and assists teachers in delivering creative and innovative instruction.

The Educate App's social networking interface enhances the speed and efficiency of engagement, communication, and cooperation between students and teachers in an online classroom network. It allows for status updates, media sharing, small group discussions, and private messaging (Brown & Kennedy, 2011). The app's mobile-based platform improves learning management oversight and provides students with the flexibility to choose their study location, pace, and timing. This aligns with research by Sun et al. (2015), which demonstrated that online learning

allows easy access to course materials without time or location restrictions. The mobility feature of the app eliminates spatial and temporal constraints, enabling students to access educational resources and submit assignments remotely. Ultimately, the Educate learning platform empowers students to guide their own learning independently (Benson, 2011).

Usability in Online Learning Platforms
The usability of online learning platforms is a critical factor in their effectiveness for pre-service teachers and other learners. This review synthesizes key principles and findings from the provided literature, focusing on aspects that contribute to the usability of these platforms.

Coherence Principle and Usability
The Coherence Principle, as discussed in the literature, is fundamental to creating usable online learning materials. This principle emphasizes the importance of designing content that is clear, relevant, and free from extraneous information. In the context of usability, this translates to:

Accessible Design: Burgstahler (2008) emphasizes the importance of creating multimedia elements that are accessible to learners with disabilities. This aspect of usability ensures that all users, regardless of their abilities, can effectively engage with the learning materials.

Intuitive Navigation: Nielsen (1993) highlights the significance of straight forward navigation in enhancing the learning experience. Usable online platforms should have a clear, intuitive structure that allows learners to easily access and navigate through content.

Methodology
This study employed descriptive survey research designs. The descriptive survey was used to assess Pre-service Teachers' Usability of Online Learning Platforms in Educational Technology in Colleges of Education. The study was conducted in South-west Nigeria, encompassing six states: Oyo, Ogun, Ekiti, Ondo, Osun, and Lagos. The population comprised 4,221 Year 2 students offering Educational Technology courses in Colleges of Education in this region during the 2022/2023 academic session. A multistage sampling process was employed, resulting in a sample size of 514 pre-service teachers. The instrument used for data collection titled: Online Platform Usability Questionnaire (OPUQ) was developed by the Researchers. The questionnaire was subjected to face validation by two Measurement and Evaluation experts and one Educational Technology expert in Nigeria Universities. The internal consistency of the instruments was determined using Cronbach Alpha. The reliability coefficients established was 0.72. The instrument was administered through personal contacts by the researchers and research assistants. Out of 514 copies of the questionnaire administered, 451 were duly filled and returned. These represented 87.74% rate of return. Mean, and standard deviations were used to answer research questions. On a four point scale, any item with a mean of 2.50 and above was considered agreed upon while less than 2.50 was considered disagreed upon.

Results
Perceived usefulness of Online Platforms

Table 1: Mean Ratings and Standard Deviation of the Pre-service Technology Teachers on the Perceived usefulness of online Platforms N=451

	Usefulness	Mean $\overline{X}$	SD
1	Online platforms is very effective for learning	3.33	0.71
2	Online platforms help to be more productive.	3.41	0.78
3	I found Online platforms useful for learning.	3.63	0.82
4	The platforms give me more control over learning activities.	3.44	0.78
5	Online platforms make learning easier.	3.56	0.81
6	Online platforms save time when I use them for learning.	3.49	0.79
7	Online platforms meet my learning needs.	3.57	0.79
8	Online platforms enhance instructional delivery.	3.46	0.81
	Average Mean	**3.48**	**0.81**

Table 1 presents the mean ratings of pre-service teachers' responses on perceived usefulness of online platforms. The average mean score on usefulness scale ($\overline{X}$ = 3.48; SD=0.81) showed that the pre-service teachers perceived online platforms useful for leaning educational technology. A closer look at the mean ratings of the items revealed that the pre-service teachers agreed with all the items ranging between $\overline{X}$ =3.36 to $\overline{X}$ =3.63 which are above the cut-off point of $\overline{X}$ =2.50 on a four pout rating scale. e.g. *Online platforms is very effective for learning($\overline{X}$ = 3.33; SD=0.71).* *The platforms give me more control over learning activities =$\overline{X}$ 3.44; SD= 0.78. I found online platforms useful for learning ($\overline{X}$ = 3.63, SD = 0.82)* and *the platforms meet my learning needs ($\overline{X}$ 3.57; SD=0.79) platforms enhance instructional delivery ($\overline{X}$ = 3.46, SD = 0.81)*. The platforms were also *perceived to make learning easier* ($\overline{X}$ = 3.56, SD = 0.81). The consistently high means and relatively low standard deviations (between 0.71 and 0.82) suggest that the respondents were closed to one another in their responses and generally agreed on the usefulness of the platforms for learning.

Perceived Ease of Use of Online Platforms

Table 2: Mean Ratings and Standard Deviation of the Pre-service Technology Teachers on the Perceived Ease of Use of online Platforms N=451

	Ease of Use	Mean $\overline{X}$	SD
1	Online platforms are easy to use	2.19	0.73
2	Online platforms are simple to use	2.21	0.88
3	Online are user-friendly	3.68	0.74
4	Online platforms require the fewest steps to possibly accomplish what I want to learn	3.41	0.78
5	Online platforms can be used effortlessly	2.15	0.73
6	Online platforms can be used without written instruction	1.28	0.87
7	I can recover from mistakes quickly and easily on the online platforms	2.22	0.71
8	I can use the Online platforms successfully and easily	2.47	0.79
	Average Mean	**2.29**	**0.75**

The average mean rating of the pre-service teachers responses on Ease of use of online platforms ($\overline{X}$ =2.29; SD= 0.75) Table 2; showed that the platforms were not ease to use by the pre-service teachers. The pre-service teachers in their perceptions agreed that online platforms were *user-friendly ($\overline{X}$ =3.86; SD= 0.74)* and that Online p*latforms required fewest steps to possibly accomplish what I want to learn ($\overline{X}$ = 3.41; SD =0.78).* However, pre-service teachers disagreed with remaining items e.g. the platforms are easy to use ($\overline{X}$ =2.19;0.73), the platforms are simple to use ($\overline{X}$ =2.21;SD=0.88), online platforms can be used effortlessly ($\overline{X}$ =2.15;SD= 0.73), Online platforms can be used without written instruction ($\overline{X}$ =1.28;SD=0.87), I can recover from mistakes quickly and easily on the online platforms ($\overline{X}$ =2.22;SD=0.71) and I can use Online platforms successfully and easily ($\overline{X}$ =2.47;SD=0.71). These suggest that some guidance might be beneficial for pre-service teachers before they can use the online platforms effortlessly.

Perceived Ease of Learning of Online Platforms

Table 3: Mean Ratings and Standard Deviation of the Pre-service Technology Teachers on the Perceived Ease of Learning of online Platforms N=451

	Ease of Learning	Mean $\overline{X}$	SD
1	I learnt to use the platforms quickly	3.37	0.77
2	I easily remember how to use it	3.43	0.78
3	It is easy to learn to use online platforms	3.21	0.74
4	I quickly became skillful with online platforms	3.11	0.72
	Average Mean	**3.28**	**0.75**

The result on Table 3, on which presents data on perceived Ease of learning of online platforms showed an average mean rating of ($\overline{X}$ =3.28; SD= 0.76) which revealed that learning to use the

online platforms was easy for the pre-service teachers. All the items had their means ratings above the cut-off point of ($\overline{X}$ = 2.50).

Perceived Satisfaction of Online Platforms

Table 4: Mean Ratings and Standard Deviation of the Pre-service Technology Teachers on the Perceived Satisfaction of online Platforms N=451

	Satisfaction	Mean $\overline{X}$	SD
1	I am satisfied with online platforms for learning	3.78	0.76
2	I would recommend online platforms to a friend	3.29	0.75
3	Online platforms are good for learning	3.47	0.79
4	Online platforms work the way I want it for instructional delivery	3.12	0.72
5	Online platforms are delightful for instructional purposes	2.78	0.65
6	I feel I need to have online platforms for learning	3.12	0.72
7	Online platforms are pleasant to use	2.66	0.63
	Average Mean	**3.17**	**0.71**

The overall mean rating of the pre-service teachers' on Perceived satisfaction with the online **platforms** dimension ($\overline{X}$ = 3.17; SD.0.71) showed that the pre-service teachers perceived online platforms satisfactory for learning educational technology. The top-rated item was their perception that they were I am satisfied with online platforms for learning ($\overline{X}$ =3.78; SD=0.76), followed by Online platforms are good for learning ($\overline{X}$ 3.47; SD=0.79). I would recommend online platforms to a friend ($\overline{X}$ =3.29; SD=0.75). Online platforms work the way I want it for instructional delivery ($\overline{X}$ =2.12; SD=0.72) and I feel I need to have online platforms for learning ($\overline{X}$ =3.12; SD=0.672). Online platforms are delightful for instructional purposes also had a mean of ($\overline{X}$ =2.78; SD = 0.65) and Online platforms are pleasant to use had a mean rating of ($\overline{X}$ =2.66; SD=0.63).

Discussion of Findings

The data indicates that users generally find online platforms highly useful for learning purposes. This aligns with several studies in the literature. For instance, Alshammari et al. (2019) found that perceived usefulness significantly influences students' intention to use e-learning systems. Similarly, Cidral et al. (2018) identified usefulness as a key factor in e-learning success. Users particularly appreciated how the platforms enhanced instructional delivery and made learning easier. However, Tarhini et al. (2017) argued that while usefulness is important, it's not always the most critical factor in e-learning adoption, especially when considering cultural differences.

The results suggest that pre-service teachers find the platforms relatively not easy to use. This is contrary to Salloum et al. (2019), who identified ease of use as a significant predictor of e-learning system acceptance. The positive perception of simplicity supports Davis's (1989) Technology Acceptance Model, which posits that perceived ease of use directly influences system adoption.

Finding from the study revealed that pre-service teachers reported some difficulty in recovering from mistakes quickly and easily, highlighting a potential area of concern pointing to the fact that intensive training would be needed for the pre-service teacher to learn to use the online platforms

for learning. This aligns with Meiselwitz & Sadera (2008), who found that usability issues, particularly in error handling, can significantly impact students' learning experiences. Pre-service teachers reported that they could learn to use the platforms quickly and easily remember how to use them. This supports findings by Lee et al. (2009), who found that learnability significantly influences user satisfaction in e-learning systems. The positive perception of quick learning aligns with Venkatesh et al.'s (2003) Unified Theory of Acceptance and Use of Technology, which emphasizes the importance of effort expectancy in technology adoption. However, pre-service teachers indicated that becoming highly skillful with the platforms was more challenging. This echoed concerns raised by Lim et al. (2007) about the need for ongoing support and training in e-learning environments. While pre-service teachers expressed satisfaction with the platforms for learning purposes, overall satisfaction levels were somewhat lower compared to usefulness and ease of use ratings. This discrepancy aligns with findings by Sun et al. (2008), who noted that while usefulness and ease of use are important, other factors like system quality and course quality also significantly impact user satisfaction.

The finding of this study also found the platforms good for learning, supporting Liaw and Huang's (2013) findings on the positive relationship between perceived usefulness and satisfaction in e-learning contexts. However, lower ratings for pleasantness and delight for instructional purposes suggest areas for improvement, echoing Zaharias & Poylymenakou's (2009) emphasis on the need for more engaging and motivating e-learning designs.

Conclusion

Based on the findings presented, online learning platforms are generally perceived positively by students for learning educational technology. The platforms score highest in usefulness, with users finding them particularly beneficial for enhancing instructional delivery and facilitating learning. However, pre-service teacher found online platforms not easy to use with some challenges exist in error recovery and advanced skill development. While pre-service teachers find the online platforms easy to learn initially, mastering them may require more time and effort.

Recommendations

Based on the findings of this study, it is recommended that;

1. National Commission for Colleges of Education should review the curriculum of Colleges of Education with a view to incorporating the use of online platform for teaching.
2. Initial training and orientation classes about the usefulness of online learning platforms should constantly be provided for new students entering Colleges of Education.
3. Lecturers in the Colleges of Education should use content lesson plans that include the integration of online learning platforms for teaching in order to allow the pre-service teachers reflect the pedagogical uses and benefits of online learning platforms integration into teaching and learning activities.
4. Administrators of Colleges of Education should continuously organize seminars and conferences for the pre-service teachers and lecturers on the pedagogical uses of online learning platforms.

5. Government and administrators of Colleges of education should work out modalities on how to provide incentives for pre-service teachers to enhance ownership of computer, iPad, or android phones for easy use of online learning platforms

References

Alshammari, S. H., Ali, M. B., & Rosli, M. S. (2019). The influences of technical support, self efficacy and instructional design on the usage and acceptance of LMS: A comprehensive review. Turkish Online Journal of Educational Technology, 18(3), 132-144.

Association for Educational Communications and Technology [AECT], (2004). The definitions and terminology committee report: The meaning of educational technology. In M. Orey (Ed.), *Emerging perspectives on learning, teaching, and technology*. https://aect.org/

Albawi, M., & Ghazi, A. (2019). The effect of using "Google classroom" on the achievement of computer department students in "Image Processing" subject, and their attitudes toward e-learning. *International Journal of Research in Educational Sciences, 2*(2), 123-170. Retrieved from http://search.shamaa.org/FullRecord?ID=240927

Andortan, J. A., Ubebe, S. A., & Aneshie-Otakpa, V. O. (2022). Effect of activity-based learning on junior secondary school students' interest and achievement in geometrical contents of mathematics. *African Journal of Science Technology and Mathematics Education, 8*(3), 232-238.

Aydin, C. C., & Tirkes, G. (2010). Open source learning management systems in e-learning and Moodle. In IEEE EDUCON 2010 Conference (pp. 593-600). IEEE.

Balasubramanian, K., Jaykumar, V., & Fukey, L. N. (2014). A study on "Student preference towards the use of Edmodo as a learning platform to create responsible learning environment". Procedia-Social and Behavioral Sciences, 144, 416-422.

Baltaci-Goktalay, S., & Ozdilek, Z. (2010). Pre-service teachers' perceptions about web 2.0 technologies. Retrieved June 10 2017, from *https://www.ac.els-cdn.com/S1877042810008001/1-s2.0-S1877042810008001-main.pdf.*

Bell, K. (2015). The teacher's guide to Google Classroom. Shake Up Learning, LLC.

Benson, P. (2011). Teaching and researching autonomy in language learning (2nd ed.). Harlow: Pearson Education.

Brown, C. (2018). Learning alliances: Integrating technology into face-to-face learning environments. In G. Williams, P. Statham, N. Brown, & B. Cleland (Eds.), Changing Demands, Changing Directions. Proceedings ascilite Hobart 2011 (pp. 184-189).

Buescher, E. (2010). The wonders of educational blogging: Solving classroom issues with Edmodo. Retrieved from http://clifmims.com/site/documents/Edmodo.pdf

BusinessWire. (2014). Edmodo releases snapshot to help teachers close learning gaps. Retrieved from https://www.businesswire.com/news/home/20141006005214/en/Edmodo-Releases-Snapshot-to-Help-Teachers-Close-Learning-Gaps

Burgstahler, S. (2008). Universal design in higher education. In S. Burgstahler & R. Cory (Eds.), Universal design in higher education: From principles to practice (pp. 3-20). Harvard Education Press.

Chandler, P. D., & Redman, C. (2013). Teaching teachers for the future: Modelling and exploring immersive personal learning networks. Australian Educational Computing, 27(3), 54-62.

Charoenwet, S., & Christensen, A. (2016). The effect of Edmodo learning network on students' perception, self-regulated learning behaviors and learning performance. In Proceedings of

the 10th International Multi-Conference on Society, Cybernetics and Informatics (IMSCI 2016) (pp. 297-300).

Cidral, W. A., Oliveira, T., Di Felice, M., & Aparicio, M. (2018). E-learning success determinants: Brazilian empirical study. Computers & Education, 122, 273-290.

Crawford, A. R. (2015). Google Classroom. American School & University, 88(3), 26.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly, 13(3), 319-340.

Diepreye, N. O., Fapohunda, E. O., & Odukoya, J. A. (2019). Edmodo-based blended learning approach and student's academic performance in economics in secondary schools in Bayelsa State, Nigeria. International Journal of Research and Innovation in Social Science, 3(8), 633-639.

Enriquez, M. A. S. (2014). Students' perceptions on the effectiveness of the use of Edmodo as a supplementary tool for learning. In DLSU Research Congress (Vol. 6, pp. 1-6).

Garrison, D. R., & Akyol, Z. (2015). Toward the development of a metacognition construct for communities of inquiry. The Internet and Higher Education, 24, 66-71.

Habley, J. (2011). AASL announces 2011 best websites for teaching and learning. American Library Association. Retrieved from http://www.ala.org/news/press-releases/2011/06/aasl-announces-2011-best-websites-teaching-and-learning

Hursen, C. (2018). The impact of edmodo-assisted education on pre-service teacher critical thinking skills. Journal of Learning and Teaching in Digital Age, 3(2), 30-41.

Iftakhar, S. (2016). Google classroom: what works and how? Journal of Education and Social Sciences, 3(1), 12-18.

Imam, S. A. (2019). Edmodo: An effective solution for increasing students' writing skill in EFL classroom. Journal of Applied Linguistics and Language Research, 6(3), 84-90.

Janzen, M. (2014). Hot team: Google Classroom. Retrieved from http://tlt.psu.edu/2014/12/04/hot-team-google-classroom

Keller, C. H. (2007). Virtual learning environment in higher education – A study of user acceptance. Retrieved June 10 2017, from http://www.Diva-portal.org/smash/get/dival2:24073/FULLTEXT01.pdf

Kongchan, C. (2013). How Edmodo and Google Docs can change traditional classrooms. In The European Conference on Language Learning 2013 (pp. 629-637).

Kuok, K. K., & Tang, A. C. Y. (2023). Engineering education for sustainable development: A structural equation modeling approach. Sustainability, 15(1), 777.

Lee, B. C., Yoon, J. O., & Lee, I. (2009). Learners' acceptance of e-learning in South Korea: Theories and results. Computers & Education, 53(4), 1320-1329.

Liaw, S. S., & Huang, H. M. (2013). Perceived satisfaction, perceived usefulness and interactive learning environments as predictors to self-regulation in e-learning environments. Computers & Education, 60(1), 14-24.

Lim, C. P., Zhao, Y., Tondeur, J., Chai, C. S., & Tsai, C. C. (2007). Bridging the gap: Technology trends and use of technology in schools. Educational Technology & Society, 10(3), 129-149.

Looi, C. Y., & Yusop, F. D. (2011). Potential use of social networking tool to assist reading comprehension: Implications for practice and future research. Journal of Educational Research, 31(1), 189-201.

Lopes-Murphy, S. (2012). Universal Design for Learning: Preparing secondary education teachers in training to increase academic accessibility of high school English learners.The Clearing House: A Journal of Educational Strategies, Issues and Ideas, 85(6), 226-230.

Manca, S., & Ranieri, M. (2013). Is it a tool suitable for learning? A critical review of the literature on Facebook as a technology-enhanced learning environment. Journal of Computer Assisted Learning, 29(6), 487-504.

Mary, J. L. (2014). Google Classroom. School Library Journal, 60(11), 14-14.

Mayer, R. E. (2001). Multimedia learning. Cambridge University Press.

Meiselwitz, G., & Sadera, W. A. (2008). Investigating the connection between usability and learning outcomes in online learning environments. Journal of Online Learning and Teaching, 4(2), 234-242.

Mosquera, L. H. (2017). Impact of implementing a virtual learning environment (VLE) in the EFL classroom. Íkala, Revista de Lenguaje y Cultura, 22(3), 479-498.

Nielsen, J. (1993). Usability engineering. Morgan Kaufmann.

Olaleye, S. B., Favour, O. A., & Ajayi, A. O. (2017). Challenges facing e-learning in Nigerian university education based on the experience of developed countries. International Journal of Managing Information Technology, 9(2), 35-46.

Osman, M. E. (2017). Factors influencing student acceptance and use of educational social networking sites: The case of Edmodo. International Journal of Computer Applications Technology and Research, 6(3), 107-115.

Pappas, C. (2015). Google Classroom review: Pros and cons of using Google Classroom in eLearning. ELearning Industry. Retrieved from https://elearningindustry.com/google-classroom-review-pros-and-cons-of-using-google-classroom-in-elearning

Pardo, A. (2014). Designing learning analytics experiences. In J. A. Larusson & B. White (Eds.), Learning analytics: From research to practice (pp. 15-38). Springer.

Piaralal, S. K., Ansari, M. A., & Amin, H. (2023). Google Classroom adoption among Malaysian university students: Extending the UTAUT2 model. Education and Information Technologies, 28(1), 1103-1134.

Pickens, J. (2005). Attitudes and Perceptions. Retrieved June 10 2017 from *http://www.healthadmin.jbpub.com/Borkowski/chapter3.pdf*

Saiyad, S., Virk, A., Mahajan, R., & Singh, T. (2021). Online teaching in medical training: Establishing good online teaching practices from cumulative experience. International Journal of Applied and Basic Medical Research, 10(3), 149-155.

Salloum, S. A., Al-Emran, M., Shaalan, K., & Tarhini, A. (2019). Factors affecting the E-learning acceptance: A case study from UAE. Education and Information Technologies, 24(1), 509-530.

Scot, N., & Ryan (2009). Internet safety and security: A guide for parents and educators. CreateSpace Independent Publishing Platform.

Shaharanee, I. N. M., & Rodzi, S. M. (2018). Google classroom as a tool for active learning. AIP Conference Proceedings, 1940(1), 020016.

Sun, J., Pryor, R., & Wen, J. (2015). A new way to understand and use online social media in college course learning. International Journal of Information and Communication Technology Education, 11(2), 84-95.

Sun, P. C., Tsai, R. J., Finger, G., Chen, Y. Y., & Yeh, D. (2008). What drives a successful e-Learning? An empirical investigation of the critical factors influencing learner satisfaction. Computers & Education, 50(4), 1183-1202.

Tarhini, A., Masa'deh, R. E., Al-Busaidi, K. A., Mohammed, A. B., & Maqableh, M. (2017). Factors influencing students' adoption of e-learning: A structural equation modeling approach. Journal of International Education in Business, 10(2), 164-182.

Thompson B., M., & Green S. (2020). Barriers to technology usage in teacher education. *Journal of Technology/Technical and Teacher Education*, *29*(2), 125-135.

Trust, T. (2012). Professional learning networks designed for teacher learning. Journal of Digital Learning in Teacher Education, 28(4), 133-138.

Trust, T. (2016). New model of teacher learning in an online network. Journal of Research on Technology in Education, 48(4), 290-305.

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. MIS Quarterly, 27(3), 425-478.

Yonas, A., Anakwue, S. C., & Oche, R. P. (2023). Usability and effectiveness of mobile learning application for improving English language speaking skills: A systematic review. Education and Information Technologies, 28(1), 1135-1157.

Zainnuri, H. (2016). The implementation of e-learning system at UIN Sumatera Utara in response to technology challenge in education. Journal of Physics: Conference Series, 970(1), 012028.

Zaharias, P., & Poylymenakou, A. (2009). Developing a usability evaluation method for e-learning applications: Beyond functional usability. International Journal of Human-Computer Interaction, 25(1), 75-98.

Zimmerman, B. J., & Schunk, D. H. (Eds.). (2001). Self-regulated learning and academic achievement: Theoretical perspectives. Routledge.